the 100-percent speed point for normalized transient duty cycles.

(e) *Intermediate test speed.* Determine intermediate test speed with the following provisions:

(1) If peak torque speed is 60 to 75 percent of the maximum test speed, the intermediate speed point is at that same speed.

(2) If peak torque speed is less than 60 percent of the maximum test speed, the intermediate speed point is at 60 percent of maximum test speed.

(3) If peak torque speed is greater than 75 percent of the maximum test speed, the intermediate speed point is at 75 percent of maximum test speed.

§ 1065.520 Engine starting, restarting, and shutdown.

Unless the standard-setting part specifies otherwise, follow the steps in this section to start and shut down the test engine:

(a) *Engine starting.* Start the engine according to the manufacturer's recommended starting procedure in the owner's manual, using either a production starter motor or the dynamometer. Use the dynamometer to crank (or motor) the engine at the typical in-use cranking speed with a fully charged battery (nominal speed ±10 percent), accelerating the engine to cranking speed in the same time it would take with a starter motor (nominal ±0.5 seconds). Stop motoring by the dynamometer within one second of starting the engine. The cycle's free-idle period begins when you determine that the engine has started.

(1) If the engine does not start after 15 seconds of cranking, stop cranking and determine the reason it failed to start. While diagnosing the problem, turn off the device that measures gas flow (or revolution counter) on the constant-volume sampler (and all integrators when measuring emissions continuously). Also, turn off the constant-volume sampler or disconnect the exhaust tube from the tailpipe. If failure to start is an operational error, reschedule the engine for testing (this may require soaking the engine if the test requires a cold-start).

(2) If longer cranking times are necessary, you may use them instead of the 15-second limit, as long as the owner's manual and the service-repair manual describe the longer cranking times as normal.

(3) If an engine malfunction causes a failure to start, you may correct it in less than 30 minutes and continue the test. Reactivate the sampling system at the same time cranking begins. When the engine starts, begin the timing sequence. If an engine malfunction causes a failure to start, and you cannot restart the engine, the test is void.

(b) *Engine stalling.* Respond to engine stalling as follows:

(1) If the engine stalls during the warm-up period, the initial idle period of test, or the steady-state segment, you may restart the engine immediately using the appropriate starting procedure and continue the test.

(2) If the engine stalls at any other time, the test is void.

(c) *Engine shutdown.* Shut the engine down according to the manufacturer's specifications.

§ 1065.525 Engine dynamometer test run.

Take the following steps for each test:

(a) Prepare the engine, dynamometer, and sampling system. Change filters or other replaceable items and check for leaks as necessary.

(b) If you are using bag samples, connect evacuated sample-collection bags to the collection system for the dilute exhaust and dilution air sample.

(c) Attach the CVS to the engine's exhaust system any time before starting the CVS.

(d) Start the CVS (if not already started), the sample pumps, the engine cooling fans, and the data-collection system. Before the test begins, preheat the CVS's heat exchanger (if used) and the heated components of any continuous sampling systems to designated operating temperatures.

(e) Adjust the sample flow rates to the desired levels and set to zero the devices in the CVS that measure gas flow. The venturi design fixes the sample flow rate in a CFV–CVS.

(f) Start the engine if engine starting is not part of the test cycle, as specified in the standard-setting part.

(g) Run the test cycle specified in the standard-setting part and collect the test data.

(h) As soon as practical after the test cycle is complete, analyze the bag samples.

§ 1065.530 Test cycle validation criteria.

(a) *Steady-state emission testing.* Make sure your engine's speeds and loads stay within ±2 percent of the set point during the sampling period.

(b) *Transient emission testing performed by EPA.* Emission tests must meet the specifications of this paragraph (b). Otherwise, they do not comply with the test cycle requirements of the standard-setting part, unless we determine the cause of the failure to meet these specifications is related to the engine rather than the test equipment.

(1) *Shifting feedback signals.* The time lag between the feedback and reference-cycle values may bias results. To reduce this effect, you may advance or delay the entire sequence of engine-speed and torque-feedback signals with respect to the reference sequence for speed and torque. If you shift the feedback signals, you must shift speed and torque the same amount in the same direction.

(2) *Calculating brake kilowatt-hour emissions.* Calculate brake kilowatt-hour emissions for each pair of feedback values recorded for engine speed and torque. Also calculate the reference brake kilowatt-hour for each pair of reference values for engine speed and torque. Calculate to five significant figures.

(3) *Performing regression-line analysis.* Perform regression analysis to calculate validation statistics as follows:

(i) Perform linear regressions of feedback value on reference value for speed, torque, and brake power on 1 Hz data after the feedback shift has occurred (see paragraph (b)(1) of this section). Use the method of least squares, with the best-fit equation having the form:

$$y = mx + b$$

Where:

y = The feedback (actual) value of speed (rpm), torque (ft-lbs.), or brake power.
m = Slope of the regression line.
x = The reference value (speed, torque, or brake power).
b = The y-intercept of the regression line.

(ii) Calculate the standard error of estimate (SE) of y on x and the coefficient of determination (r^2) for each regression line.

(iii) For a valid test, make sure the feedback cycle's integrated brake kilowatt-hour is within 5 percent of the reference cycle's integrated brake kilowatt-hour. Also, ensure that the slope, intercept, standard error, and coefficient of determination meet the criteria in the following table (you may delete individual points from the regression analyses, consistent with good engineering judgment):

TABLE 1 OF § 1065.530—STATISTICAL CRITERIA FOR VALIDATING TEST CYCLES

	Speed	Torque	Power
1. Slope of the regression line (m).	0.980 to 1.020	0.880 to 1.030	0.880 to 1.030.
2. Y intercept of the regression line (b).	$\|b\| \leq$ 40 rpm	$\|b\| \leq$ 5.0 percent of maximum torque from power map.	$\|b\| \leq$ 3.0 percent of maximum torque from power map.
3. Standard error of the estimate of Y on X (SE).	100 rpm	15 percent of maximum torque from power map.	10 percent of maximum power from power map.
4. Coefficient of determination (r^2).	$r^2 \geq 0.970$	$r^2 \geq 0.900$	$r^2 \geq 0.900$.

(c) *Transient testing performed by manufacturers.* Emission tests that meet the specifications of paragraph (b) of this section satisfy the standard-setting part's requirements for test cycles. You may ask to use a dynamometer that cannot meet those specifications, consistent with good engineering practice. We will approve your request